

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants: HAGEL, Rainer et al.

Serial No.: 10/583,510

371(c) Date: June 15, 2007

For: THERMAL PRE-IGNITION AGENTS

Examiner: MCDONOUGH, James E

Art Unit: 1793

Conf. No.: 1315

**AMENDMENT AFTER FINAL REJECTION**

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Sir:

March 8, 2010

This is in response to the Office Action mailed December 8, 2010, in connection with the above-identified application. The amendments are listed below and set forth on the following pages.

Amendments to the Claims; and

Remarks are included following the amendments.

### Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

### Listing of Claims:

1. (Canceled)

2. (Currently Amended) Thermal pre-ignition agents having an adjustable deflagration point and a composition comprising from 10 to 50 wt. % dipicrylaminoethyl nitrate, from ~~40 to 60~~ 25 to 75 wt. % of an oxidizing agent, and 10 to 60 wt. % of a nitrogen-containing compound other than dipicrylaminoethyl nitrate and the oxidizing agent, wherein the thermal pre-ignition agent has a deflagration point controlled based on the composition thereof.

3. (Previously Presented) Thermal pre-ignition agents according to claim 2, characterized in that the oxidizing agent is selected from one or more of the nitrates of the alkali and/or alkaline earth metals and/or of ammonium, of the perchlorates of the alkali and/or alkaline earth metals and/or of ammonium, and of the peroxides of the alkaline earth metals and/or of zinc.

4. (Previously Presented) Thermal pre-ignition agents according to claim 2, characterized in that the nitrogen-containing compound is selected from one or more of nitroguanidine, nitroaminoguanidine, nitrotriazolone, derivatives of tetrazole and/or salts thereof, nitraminotetrazole and/or its salts, aminoguanidine nitrate, diaminoguanidine nitrate, triaminoguanidine nitrate, guanidine nitrate, dicyandiamidine nitrate, and diaminoguanidine azotetrazolate.

5. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition further comprises from 1 to 80 wt. % of a reducing agent.

6. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition further comprises from 1 to 80 wt. % of a binder.

7. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition further comprises from 10 to 80 wt. % of at least one high-energy additive.

8. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition further comprises from 0.1 to 20 wt. % of at least one combustion moderator and processing aid.

9. (Previously Presented) A thermal fuse for use in gas generators for motor vehicle safety systems, comprising a thermal pre-ignition agent according to claim 2.

10. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition comprises from 10 to 30 wt. % of the dipicrylaminoethyl nitrate.

11. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition comprises from 20 to 40 wt. % of the nitrogen-containing compound.

12. (Previously Presented) Thermal pre-ignition agents according to claim 5, wherein the composition comprises from 1 to 40 wt. % of the reducing agent.

13. (Previously Presented) Thermal pre-ignition agents according to claim 5, wherein the composition comprises from 1 to 15 wt. % of the reducing agent.

14. (Previously Presented) Thermal pre-ignition agents according to claim 5, wherein the reducing agent is selected from one or more of aluminum, titanium, titanium hydride, boron, boron hydride, zirconium, zirconium hydride, silicon, graphite, activated carbon, and carbon black.

15. (Previously Presented) Thermal pre-ignition agents according to claim 6, wherein the composition comprises from 1 to 40 wt. % of the binder.

16. (Previously Presented) Thermal pre-ignition agents according to claim 6, wherein the composition comprises from 1 to 20 wt. % of the binder.

17. (Previously Presented) Thermal pre-ignition agents according to claim 6, wherein the is binder selected from one or more of cellulose and derivatives thereof, polyvinylbutyrals, polynitropolyphenylene, polynitrophenyl ether, Plexigum, polyvinyl acetate and copolymers.

18. (Previously Presented) Thermal pre-ignition agents according to claim 7, wherein the composition comprises from 10 to 50 wt. % of the at least one high-energy additive.

19. (Previously Presented) Thermal pre-ignition agents according to claim 7, wherein the composition comprises from 10 to 30 wt. % of the at least one high-energy additive.

20. (Previously Presented) Thermal pre-ignition agents according to claim 7, wherein the at least one high-energy additive is selected from one or more of hexogen, octogen and nitrocellulose.

21. (Previously Presented) Thermal pre-ignition agents according to claim 8, wherein the composition comprises from 0.1 to 10 wt. % of the at least one combustion moderator and processing aid.

22. (Previously Presented) Thermal pre-ignition agents according to claim 8, wherein the at least one combustion moderator and processing aid is selected from one or more of ferrocene and derivatives thereof, acetonylacetates, salicylates, silicates, silica gels and boron nitride.

23. (Previously Presented) Thermal pre-ignition agents according to claim 2, wherein the composition has a deflagration point in a range of 178°C to 208°C.

24. (Previously Presented) Thermal pre-ignition agents according to claim 23, wherein the composition has a deflagration point below 200°C.

25-26. (Canceled)

## REMARKS

By this amendment, applicants have amended claim 2 to recite that the oxidizing agent is contained in the thermal pre-ignition agent in an amount of from 25 to 75 wt. %. See, e.g., original claim 2. Applicants have canceled claims 25 and 26 without prejudice or disclaimer.

Since the foregoing amendments merely cancel claims (claims 25 and 26) and amend claim 2 to address the requirement of form contained in the Office Action (the rejection of claim 2 and claims 5-7 and 18 under 35 U.S.C. 112, second paragraph), entry of this amendment under 37 CFR 1.116 is requested.

The restriction between claims 2-8 and 10-24, on one hand, and claim 9, on the other hand, and the withdrawal of claim 9 from consideration as being directed to a non-elected invention are traversed. The rejected claims and claim 9 are not related as mutually exclusive species in an intermediate-final product relationship, as alleged in the Office Action. Clearly, the rejected claims and claim 9 do not recite mutually exclusive characteristics of different species since the thermal pre-ignition agent used in the thermal fuse is, by definition in claim 9, the thermal pre-ignition agent set forth in claim 2. Rather, claim 9 and the rejected claims are related as combination and subcombination. As such, restriction can only be required if, inter alia, the combination as claimed does not require the particulars of the subcombination as claimed for patentability. Here, the combination as claimed (claim 9) includes all of the particulars of the claimed subcombination

(claim 2). Therefore, restriction is not proper. Accordingly, examination of claim 9 on the merits is requested.

In view of the foregoing amendments, it is submitted all the claims now in the application comply with the requirements of 35 U.S.C. §§112, second paragraph. Therefore, reconsideration and withdrawal of the rejection of claims 2, 5-7 and 18 under 35 U.S.C. §112, second paragraph, are requested.

Claims 2-8 and 10-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,379,007 to Fifer et al. in view of the article by Clark in *Ind. Eng. Chem.*, 1933, 25(12), 1384-1390 (hereinafter "Clark"). Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to thermal pre-ignition agents having an adjustable deflagration point. The thermal pre-ignition agents have a composition comprising from 10 to 50 wt. % dipicrylaminoethyl nitrate, from 25 to 75 wt. % of an oxidizing agent, and 10 to 60 wt. % of a nitrogen-containing compound other than dipicrylaminoethyl nitrate and the oxidizing agent. The thermal pre-ignition agent has a deflagration point controlled based on the composition thereof.

The Fifer et al. patent relates to novel nitramine propellant compositions for guns and rockets, and is based on the alleged finding that the burn rate of nitramine propellants can be significantly increased over a wide range of pressures by incorporating therein a metal tetrahydridoborohydride of the formula  $\text{Me}(\text{BH}_4)_x$ , wherein Me represents an alkali metal or an alkaline earth metal, and x is 1 when Me is an alkali metal

and x is 2 when Me is an alkaline earth metal. It is disclosed that, preferably, the propellant compositions contain the nitramine component in amount of about 50-80% of the total weight of the propellant composition, and that the nitramine propellants include but are not limited to RDX, HMX, Tetryl (2,4,6-trinitrophenyl methyl nitramine, NGU (nitroguanidine) and EDNA (ethylenedinitramine). It is further disclosed that the propellant compositions may contain other additives conventionally employed in nitramine based propellants, e.g. other oxidizers such as ammonium nitrate and TNT, metals such as aluminum, carbon black, plasticizers, etc in amounts of about 0-20% of the total weight of the propellant.

As recognized by the Examiner, the Fifer et al. patent does not disclose the use of dipicrylaminoethyl nitrate. Also, the Fifer et al. patent does not disclose a composition including 10 to 50 wt. % dipicrylaminoethyl nitrate, from 25 to 75 wt. % of an oxidizing agent, and 10 to 60 wt. % of a nitrogen-containing compound other than dipicrylaminoethyl nitrate and the oxidizing agent. For example, the amount of oxidizer described in Fifer et al. is only about 0-20% of the total weight of the propellant. Certainly, the Fifer et al. patent also does not disclose thermal pre-ignition agents having an adjustable deflagration point, in which the deflagration point is controlled based on the composition thereof, as presently claimed.

The Fifer et al. patent deals with the problem:

That prior to the present invention, no catalyst have been shown to be capable of accelerating the burn rate of nitramines and nitraminepropellants except under very low pressure conditions where the binder controls the burn rate.

See, column 2, lines 16-20.

The proposed solution according to Fifer et al. consists in:

A propellant composition, which comprises a particulate organic nitramine propellant and an effective amount for burn rate acceleration of a metal tetrahydridoborohydride of the following formulae  $\text{Me}(\text{HH}_4)_x$  wherein Me represents an alkali metal or an alkaline earth metal and x is 1 when Me is an alkali metal and x is 2 when Me is an alkaline earth metal.

See, claim 1.

In other words, “particulate organic nitramine propellant” can be used as long as “an effective amount ... of a metal tetrahydridoborohydride” is present in the propellant composition. The essential feature of Fifer et al. consists therefore in the presence of the claimed metal tetrahydridoborohydride as a catalyst for accelerating the burn rate. Only once in the whole description of Fifer et al. is Tetryl (2,4,6-trinitrophenyl methyl nitramine) ever mentioned among various other propellants.

The novel metal tetrahydridoborohydride catalysts, including mixtures thereof, are effective for improving the ignition and combustion characteristics of nitramine propellants generally, including but not limited to RDX, HMX, Tetryl (2,4,6-trinitrophenyl methyl nitramine, NGU (nitroguanidine) and EDNA (ethylenedinitramine).

See, column 7, lines 3-9.

Therefore, it has to be regarded as a hindsight approach that one of ordinary skill in the art would search for another nitramine propellant and moreover among the “analogs of Tetryl” described by Clark. It is further of note that the present invention deals with the problem of accelerating the burn rate of nitromine propellants.

The object of the present invention was to provide pyrotechnic mixtures having ignition temperatures of about 200°C and adequate

long-term stability, which mixtures can be use as thermal pre-ignition agents for gas generators in the motor vehicle safety systems.

See, page 1, lines 18-22 of Applicants' specification.

Moreover, to solve this problem, the present invention does not require the essential feature of Fifer et al., the "presence of a metal tetrahydridoborohydride in the propellant composition" as a necessary constituent of the composition.

It is acknowledged and already described in Applicants' specification that Clark disclosed the preparation of dipricrylaminoethyl nitrate (Hexanitrodiphenylaminoethyl nitrate). But Clark specifies the ignition temperature of hexanitrodiphenylaminoethyl nitrate at 390°C to 400 °C and gives no hint or suggestion by which measures (e.g., addition of other agents) the deflagration point could be included. According to the present invention it was found that:

The deflagration point of pure DPN is at about 200. Surprisingly, it has been found that, in mixtures of DPN with selected components as additives, the deflagration point can be controlled in the range from 178°C to 280 °C, and the deflagration temperatures of the mixtures may be lower than those of the individual components. For pre-ignition agents, deflagration temperatures below 299 °C are of particular interest.

See, page 2, lines 2-9 of Applicants specification

The allegation in the Office Action regarding all compositions being capable of deflagration having an adjustable deflagration point is not justified by the cited references. Both cited references give no hint or suggestion as to other ingredients of a composition for adjusting the deflagration point. Moreover, the particle size is only mentioned by Fifer et al. in that "... rocket propellant compositions usually have a particle size below 1000 microns and

often as low as 1-20 microns.” All examples in Fifer et al. are carried out with nitroamines having a particle size of 150-300 microns so that no dependency of any other property could be determined, so that the allegation in the Office Action regarding deflagration points is not supported by the cited state of the art.

Moreover, even assuming, *arguendo*, one of ordinary skill in the art would have used dipicrylaminoethyl nitrate as the nitramine propellant in Fifer et al., there would have been no reason to include the dipicrylaminoethyl nitrate in an amount of 10 to 50 wt. % along with from 25 to 75 wt. % of an oxidizing agent and 10 to 60 wt. % of a nitrogen-containing compound other than dipicrylaminoethyl nitrate and the oxidizing agent to provide thermal pre-ignition agents having an adjustable deflagration point, in which the deflagration point is controlled based on the composition thereof, as presently claimed.

Accordingly, the presently claimed invention is patentable over the proposed combination of documents.

In view of the foregoing amendments and remarks, entry of this amendment, consideration of claim 9, and favorable reconsideration and allowance of all the claims now in the application are requested.

Please charge any shortage in the fees due in connection with the filing of this paper, to the deposit account of Antonelli, Terry, Stout & Kraus,

LLP, Deposit Account No. 01-2135 (Case: 306.46280X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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